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[54] SCANNING FORCE MICROSCOPE

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Agoura Hills, Calif.[21] Appl. No.: **950,030**[22] Filed: **Oct. 14, 1997**[51] Int. Cl.⁶ **G01B 5/28**[52] U.S. Cl. **73/105**[58] Field of Search 73/105; 250/306,
250/307[56] **References Cited**

U.S. PATENT DOCUMENTS

Re. 34,489	12/1993	Hansma et al.	250/260
Re. 35,514	5/1997	Albrecht et al.	250/216
4,935,634	6/1990	Hansma et al.	250/260
5,025,658	6/1991	Elings et al.	73/105
5,144,833	9/1992	Amer et al.	73/105
5,172,002	12/1992	Marshall	250/561
5,189,906	3/1993	Elings et al.	73/105
5,206,702	4/1993	Kato et al.	356/358
5,231,286	7/1993	Kajimura et al.	250/234
5,245,863	9/1993	Kajimura et al.	73/105
5,260,824	11/1993	Okada et al.	359/368
5,388,452	2/1995	Harp et al.	73/105
5,394,741	3/1995	Kajimura et al.	73/105
5,406,833	4/1995	Yamamoto	73/105
5,440,920	8/1995	Jung et al.	73/105
5,463,897	11/1995	Prater et al.	73/105
5,481,908	1/1996	Gamble	73/105
5,496,999	3/1996	Linker et al.	250/306
5,524,479	6/1996	Harp et al.	73/105
5,560,244	10/1996	Prater et al.	73/105
5,587,523	12/1996	Jung et al.	73/105
5,625,142	4/1997	Gamble et al.	73/105

5,760,300 6/1998 Kajimura 73/105

OTHER PUBLICATIONS

Steven M. Clark et al.; "A High Performance Scanning Force Microscope Head Design"; Apr. 1993; pp. 904-907; Rev. Sci. Instruments 64(4).

Kees. O. Van Der Werf et al.; "Compact Stand-Alone Atomic Force Microscope"; Oct. 1993; pp. 2892-2897; Rev. Sci. Instruments 64(10).

B. Gasser et al. Design of a 'Beetle-Type' Atomic Force Microscope Using The Iseam Deflection Technique; May 1996; pp. 1925-1929; Rev. Sci. Instruments 67(5).

Y. Martin et al. "Atomic Force Microscope-Force Mapping and Profiling on a Sub 100Å Scale"; May 15, 1987; pp. 4723-4729; J. Appl. Physics 61(10)

P.S. Jung et al. "Novel Stationary-Sample Atomic Force Microscope with Beam-Tracking Lens" 4 Feb. 1993; pp. 264-266; Electronic Letters vol. 29 No. 3.

David R. Baselt et al. "Scanned Cantilever Atomic Force Microscope"; Apr. 1993; pp. 908-911; Rev. Sci. Instruments 64(4).

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[57] **ABSTRACT**

A scanning force microscope (**10**) sometimes referred to as an atomic force microscope employs a laser (**32**) and a cantilever (**28**) which move proportionally to a moving reference frame (**64**). A fixed reference frame (**11**) contains optical components. A scanning mechanism creates relative movement between the fixed and moving reference frames. An optical assembly (**114**) is included which comprises at least one optical device in the fixed reference frame. The optical assembly permits initial alignment of the laser beam onto the cantilever and also permit the laser beam to follow the moving cantilever.

10 Claims, 8 Drawing Sheets